

Track Preference: PM Perspectives

Presentation Title: Managing Small Spacecraft Projects: Less Is Not Easier

Synopsis:

This presentation tackles the common misconception that managing small spacecraft projects is easier than managing large projects. It identifies unique difficulties, not directly derived from resource limitations, faced by managers of small projects and discusses potential mitigations for these difficulties.

Abstract:

Managing small, low cost missions (class C or D) is not necessarily easier than managing a full flagship mission. Yet, small missions are typically considered easier to manage and used as a training ground for developing the next generation of project managers. While limited resources can be a problem for small missions, in reality most of the issues inherent in managing small projects are not the direct result of limited resources. Instead, problems encountered by managers of small spacecraft missions often derive from 1) the perception that managing small projects is easier – if something is easier it needs less rigor and formality in execution, 2) the perception that limited resources necessitate or validate omitting standard management practices, 3) less stringent or unclear guidelines or policies for small projects, and 4) stakeholder expectations that are not consistent with the size and nature of the project. For example, the size of a project is sometimes used to justify not building a full, detailed integrated master schedule. However, while a small schedule slip may not be a problem for a large mission, it can indicate a serious problem for a small mission with a short development phase, highlighting the importance of the schedule for early identification of potential issues. Likewise, stakeholders may accept a higher risk posture early in the definition of a low-cost mission, but as launch approaches this acceptance may change. This presentation discusses these common misconceptions about managing small, low cost missions, the problems that can result, and possible solutions.

Bios:

Bryan Barley

Bryan Barley is currently the deputy chief engineer for NASA HQ's Science Mission Directorate. Prior to this Mr. Barley was the chief engineer for NASA's Lunar Quest Program and the Discovery Program as part of NASA's Science Mission Directorate. Mr. Barley has worked for NASA Marshall Space Flight Center (MSFC) for over 18 years. He has served as a lead systems engineer on various projects including for the development of crew training systems and for the development of International Space Station flight hardware and flight simulators. Mr. Barley also supported Spacelab on-orbit experiment operations as an astronaut crew training manager for science payloads and as a crew interface communicator for on-orbit science payload operations. Mr. Barley is currently focusing on the agency-level technical oversight of the Science Mission Directorate's various programs, projects, and technology development efforts. Mr. Barley is the recipient of the NASA Space Flight Awareness Honoree Award and the NASA Exceptional Service Medal. Mr. Barley is married with four children. He enjoys traveling and family activities. He has participated as a youth soccer coach for the past 15 years and loves every minute of it. Mr. Barley is also a percussionist who actively performs in his local area and operates a percussion education studio.

Marilyn Newhouse

Marilyn Newhouse is currently a Principle Lead Systems Engineer at CSC. Marilyn has more than 30 years experience supporting NASA contracts. During her tenure with CSC, she supported software development, systems engineering, and management positions for the Hubble Space Telescope (HST) ground system at the Goddard Space Flight Center and the Chandra X-Ray Observatory ground system

at the Marshall Space Flight Center (MSFC). She briefly supported operations integration for the Orbital Space Plane (OSP) Program at MSFC, and provided operations concept and cost estimation support for early Constellation heavy lift launch vehicle and fuel depot studies. Most recently she has supported the Discovery, New Frontiers, and Lunar Quest Program Office at MSFC, providing software development, ground system, and spacecraft operations expertise to the program office, as well as modeling and estimation tool development, special studies involving life cycle cost and fault management processes, and program budget analyses. Ms. Newhouse is a co-author on the NASA Fault Management Handbook and co-Chair of the Advanced Multi-Mission Operations System Working Group funded by NASA HQ. Ms. Newhouse is the recipient of the NASA Public Service medal and the CSC President's Technical Excellence Award.



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# **Managing Small Spacecraft Projects: Less Is Not Easier**

**NASA 2012 PM Challenge**

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CSC- Huntsville



## Introduction (1 of 2)

**Small missions are often used as a training ground for developing the next generation of project managers**

- Lower cost, smaller teams, shorter schedules
- Acceptance of higher mission risk (class C or D)

**Problems encountered by managers of small spacecraft missions derive from**

- 1) A perception that managing small projects is easier – if something is easier it needs less rigor and formality in execution
- 2) A perception that limited resources require/allow the omission of standard management practices
- 3) Less stringent or unclear guidelines or policies for small projects
- 4) Stakeholder expectations that are not consistent with the size and nature of the project or that change as launch approaches
- 5) A perception that the extensive use of heritage/proven systems and technologies requires fewer resources and less experienced development and test personnel



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## Introduction (2 of 2)

**In reality, managing small, low cost missions can be just as difficult**



- Higher risk technical solution
- Same or increased external interfaces
- External (inter-agency or inter-program priorities and commitments
- International commitments
- Less experienced personnel or institution
- Limited resources & relative organizational hierarchy

Peter Drucker, “Efficiency is doing things right; effectiveness is doing the right things.”

**Presentation addresses these issues from both the program and project perspective**



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# The Team

**The team itself is both the biggest strength of and a significant weakness to the project manager, i.e. the two faces of the team**

- Training ground for inexperienced team members
- Experience on large missions, may not directly transfer
- Often the up-and-coming personnel or the “B” team
- Inefficiencies due to splitting or sharing personnel across projects
- Competition for resources and turnover: reassignment to more critical missions
- Changing or combined roles and responsibilities



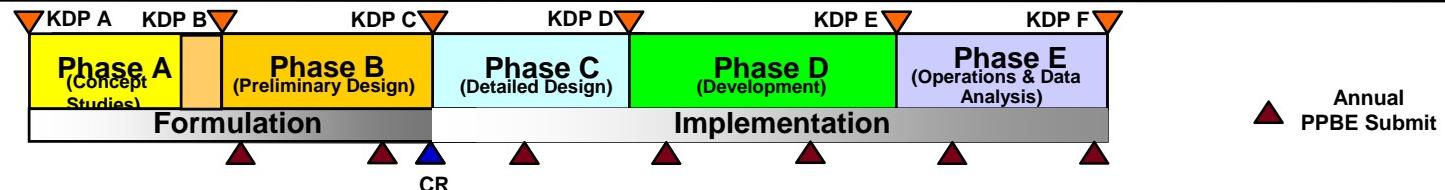
## Recommendations

- Ensure sufficient management time for developing project specific policies
- Clearly define and document roles and responsibilities early in the project; map against traditional roles, responsibilities, and processes to identify and close gaps
- Plan for turnover: identify staffing alternatives early on, cross-train
- Build in schedule slack to accommodate for inexperience and low-level task maturity
- Develop and maintain processes for communicating policies and training personnel



# Reviews and Reporting

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## Overall, the NASA life cycle remains the same

- Required NASA milestone reviews and key decision points (KDPs)
- Annual Programming, Planning, Budgeting, and Execution (PPBE) process
- Weekly and monthly program, directorate, and institution reporting requirements still apply; agency reporting may apply
- Additional external customer reviews also apply, especially for international missions

## Recommendations

- Understand all required internal and external review and reporting requirements
- Carefully negotiate terms of reference (TOR) and review success criteria with the program, project, and review board chair
- Include time before and during reviews to “set the stage” and educate the reviewers
- Use waivers and project documentation to clearly document the project approach
- Allow sufficient time for team to develop and internally review packages
- Inexperienced project management team may need additional coaching



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# Communication

## External communication may become more complex

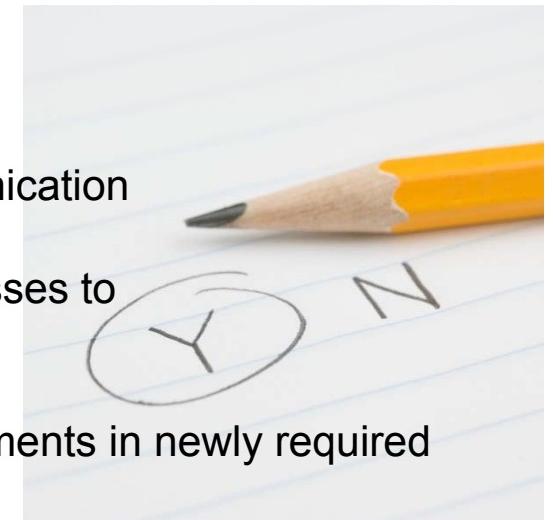
- Language barriers
- Differing process or responsibility assumptions between agencies
- Multiple layers of responsibility
- Limited dedicated personnel and experience

## Internal communication becomes more critical even though smaller team appears to favor face-to-face time with management

- Roles and responsibilities may be allocated differently
- Team inexperience may require more coaching
- Changes to processes based on mission size and risk posture may require training and monitoring
- Turnover increases the risk of losing critical knowledge

## Recommendations

- Develop a communications plan early (need not be formal)
- Ensure paths and mechanisms exist for frequent, scheduled communication
- Monitor that communication is occurring
- Write decisions down; actively use waiver, risk, liens & threats processes to make and record decisions
- Manage turnover through planned succession coaching/training
- Capture outcome of mission directorate, program, and project agreements in newly required formulation agreement





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# Schedules

## A well-constructed schedule is more critical as project duration decreases

- 10% behind on a 2 year schedule is ~2 ½ months
- Financial reporting is typically 4 – 6 weeks behind
- Could only have 1 month to catch and correct problems without tapping reserves

## Recommendations

- Build a schedule, but build it smarter: task alternatives and interrelated aspects
- Include all key tasks and products required to meet and pass reviews
- Include communications steps to ensure team can handle the reporting and communications requirements
- Look for and include all critical paths: primary, secondary, tertiary relationships
- Ensure no team member goes more than 2 weeks without a tangible product or milestone
- Maintain an active list of open issues with firm decision dates that is tracked weekly by management

**Management team must understand task, reporting, delivery, integration and test interrelationships of the schedule**





# Earned Value Management (EVM)

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## Managers often struggle with the return on investment value versus the cost of implementing EVM

- EVM is primarily a management tool, not a reporting tool
  - » Reality says institutional management uses EVM to predict future performance
  - » Project managers use it to predict their reserve burn rates
- Tight schedules, limited reserves, team inexperience all increase the criticality of timely identification of cost and schedule issues more
- Cutting corners results in poor quality data
- Required for projects with life cycle costs >\$20M

## Recommendations

- Do EVM (internally, if not formally required), but make it work for you
  - Plan EVM approach and systems in formulation phase
  - Tailor for a low-cost mission approach
  - Develop an easily communicated and repeatable process
- Actively use the integrated cost and schedule to validate progress and identify problem areas
- Understand all risks to maintaining schedule





# Risk Management (1 of 2)

## Less stringent or unclear guidelines or policies for small projects

- NASA Space Flight Program and Project Management Requirements (NPR 7102.5) and Risk Classification for NASA Payloads (NPR 8705.4) provide guidelines for class A and B missions
- Guidelines become less stringent for class C and D missions
  - » If the guideline is “may,” who and how is the decision made regarding what is “good enough”?
  - » How is the risk posture defined, documented, accepted, and communicated?
  - » What are the ramifications for the project and program of those decisions?
  - » Reviewers, customers, stakeholders, and team members may hold very different views on the answers to those questions
- Unless documented, expectations can change over time especially as launch or “go live” approach
  - » Turnover in project or review team members brings in new ideas and loses corporate knowledge
  - » Problems or failures on other projects can increase risk aversion
  - » Risk aversion naturally increases as operational reality approaches



**All projects must meet a risk-informed confidence level, regardless of project size**





# Risk Management (2 of 2)

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## Recommendations

- Tackle risk management during project formulation; continue the discussions until agreement is reached
- Clearly, carefully document risk posture(s) and rationale(s): project formulation agreement, project plan, risk management plan
- Educate team, reviewers, customers, and stakeholders regarding the risk posture, assumptions, and ramifications
- Assign risk management process and lead responsibility to one person; define risk board quorum membership to the lowest level of responsibility to keep process moving/current
- Hold regular risk board meetings regardless of schedule pressures
- Incorporate risk posture into all design decisions, including heritage trade studies
- Incorporate risk analysis into all engineering processes
- Understand new requirements such as Threat Summary Analysis, Protection Plan, and Security Plan





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# Summary

**THE BOTTOM LINE?** Good management and engineering practices are as important for successfully managing small projects as for managing large projects

## Management pitfalls

- Inexperienced, resource-constrained teams
- Constrained cost and schedule
- Unclear guidelines and requirements
- Changing expectations
- Unrealistic perceptions of process overhead
- Short memories amongst institutional managers



## Management tools

- Carefully developed, detailed schedule: know risks and critical paths
- Weekly management insight into progress based on EVM
- Frequent formal and informal defined communication
- Careful documentation of risk posture, design decisions, and rationales
- Education of team, reviewers, and stakeholders
- Re-education of team, reviewers, and stakeholders at every opportunity





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# Acknowledgements